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Introduction

After almost a century of sharing the limelight for developments in physical science, Relativity Theory and Quantum Mechanics have yet to come to terms with each other completely. Various attempts have been made to harmonise these two views of reality. Until now none has shown the one to be a direct consequence of the other.

This article does exactly that, developing all the various findings of the Special Theory of Relativity from fundamental tenets of Quantum Mechanics.

It also opens the way to serious consideration of yet deeper scientific truths.

Background Information

Einstein's Special Theory of Relativity states that the fundamental laws of science apply identically in all inertial frames of reference – i.e. for any object or system of objects moving at a steady speed in any given direction, not subject to any gravitational field. This Theory, and its more powerful younger sibling, The General Theory of Relativity (applicable to all frames of reference) have stood the test of time and been amply proved by practical experiments.

Einstein made his remarkable breakthrough by considering the perceived invariance of the speed of light, and the implications of travelling at that speed. At that time various researchers, notably Michelson and Morley, were conducting experiments aimed at detecting variations in the measured speed of light due to the movement of the earth through the 'luminiferous aether', the supposed medium by which light was assumed to be carried through otherwise empty space. No variation was detected, giving rise to the conclusion that no such aether existed.

Einstein carried this conclusion one major step forward, inferring that the speed of light **i**s, ipso facto, an absolute, the same for all states of motion. From this he further inferred that all motion is itself relative, that no fixed reference-frame exists from which absolute states of motion may be measured. In this respect, any object may with equal validity regard its state as being 'at rest' and objects not sharing that state as being 'in motion'. This leads of course to a position of total reciprocity: if object A, at rest, observes object B moving at a certain speed in a given direction, then object B, at rest, will see A moving at that same speed in the opposite direction – and both will be correct. Both interpretations are true, which you choose depends upon your standpoint.

Implications

This formulation introduces a number of interesting ramifications. First, it requires that time should be given the same sort of status as the three spatial dimensions in the fundamental laws of physics. This leads to the now-familiar concept of a 4-dimensional 'spacetime', through which everything is moving in its own particular 'direction'. To balance the books, time has to be regarded as an 'imaginary' dimension, in the mathematical sense of including the factor *i,* the square root of minus one – this is an important consideration which we will return to later.

Secondly, object A (at rest) will see object B (in motion) as experiencing time more slowly than A itself; reciprocally B will observe exactly the same, to the same degree, of A – and both will be correct. Again, more on this later.

Thirdly, A may see event P as occurring before event Q, whereas B may see Q as occurring before P – and both will be correct. Sequencing of cosmic events is not an absolute, a given; it too depends on your frame of reference. More on this also, below.

Following on from this, Einstein deduced that any transfer of matter or even information ('signals') at faster than the speed of light would not be possible, since this would be tantamount to travelling backwards in time. This issue in particular has provoked much discussion and investigation; the following text offers a full resolution.

Finally, the mass of an object in motion must be greater than the mass of that same object at rest, mass increasing with velocity, approaching infinity as the object approaches the speed of light. Inert mass, its relation to energy and its increase with any increase in velocity, are all fully dealt with below.

The Quantum Connection

Quantum mechanics teaches us that the fundamental building blocks of all matter are the whorls and vortices of cyclical wave-like energy flows. The oscillating atoms in a molecular bond themselves consist of nucleons and electrons each in turn performing a spherical harmonic dance-within-the-dance. Electrons have been shown to be, in some sense, energy-wave constructs. For their part each nucleon is comprised of quarks and gluons, patterns of energy that interweave yet further within this atomic tarantella.

It seems evident that time-related phenomena associated with such structures must be a direct consequence of these interplays of their constituent elements. The performance of any reliable atomic

clock must depend on the energy interactions within and between the structures involved.[1] It follows that time-perception in any material object or system must depend on the speed of the fundamental cyclical energy flows within that system. Slow down those energy flows and the dance proceeds more slowly, those events that mark time (literally) will occur at a correspondingly slower pace.

[Note: nowhere in this article are the principles of Special Relativity (SR) assumed (nor, conversely, assumed to be false). For those with an SR back-ground, however, it may for the purpose of completeness be helpful to consider the following text to relate to a specific inertial reference frame.]

It is apparent that the inherent speed of this fundamental energy-flow is constant for all matter. Were this not so the characteristics of different samples of the same type of matter, or the same sample at different times, would not be consistent; the possibility of different energy-flow speeds in different elements of the same object is discounted below. It is also evident that the instantaneous velocity of any energy flow within an object in motion will consist of two components: the intrinsic, or cyclical, component previously referred to; and the extrinsic linear component that keeps pace with the motion of the object. Put simply, if an element of intrinsic flow within the object at rest performs a simple circular motion, then that element of flow will describe a spiral – round and along, together - if the object is given a constant velocity in a direction perpendicular to the plane of circular motion. The purely cyclical component of speed of any element of energy flow in a moving object is thus necessarily less than the corresponding full speed of flow in the same object at rest [2]. Since only this component drives the periodic activity within the constituent elements of the object, the passage of time will manifest more slowly in an object in motion than in that same object at rest.

If fundamental flow speed is denoted by f, then it can be shown that each element of flow within an object in motion at constant velocity v experiences an intrinsic component of flow speed, averaged over that element's periodic cycle, of $\sqrt{(f^2 - v^2)}$. The rate of passage of time as experienced by that object will thus be reduced by a factor $\sqrt{(f^2 - v^2)} / f$, or: $\sqrt{(1 - v^2/f^2)}$. [3]

[1] Certain periodic actions include a probabilistic element, such as the stochastic process of radioactive decay. This is most likely to be due to phase relationships between the waveforms of interacting energy flows at critical points in the energy-cycle of inherently unstable atoms.

[2] The possibility of increased rates of flow in moving objects is considered, and discounted, later in this article.

Relatively Speaking

Those familiar with Relativity Theory will recognise the above as the time-dilation factor of SR, with c replaced by f. Note that this result has been arrived at without any reference to the speed of light.

This result states that intrinsic flow rate and object speed of motion are linked by Pythagoras' relationship as the two shorter sides of a right angled triangle whose hypotenuse is the actual flow rate, f. In other words, in a mathematical sense at least, rate of passage of time for any object or system may be regarded as being orthogonal (perpendicular) to spatial speed (not velocity – direction is immaterial in this context).

This relationship may be represented as shown in figure 1, the angle ϑ representing (in a simple sense [4]) the 'pitch of the spiral' referred to above.

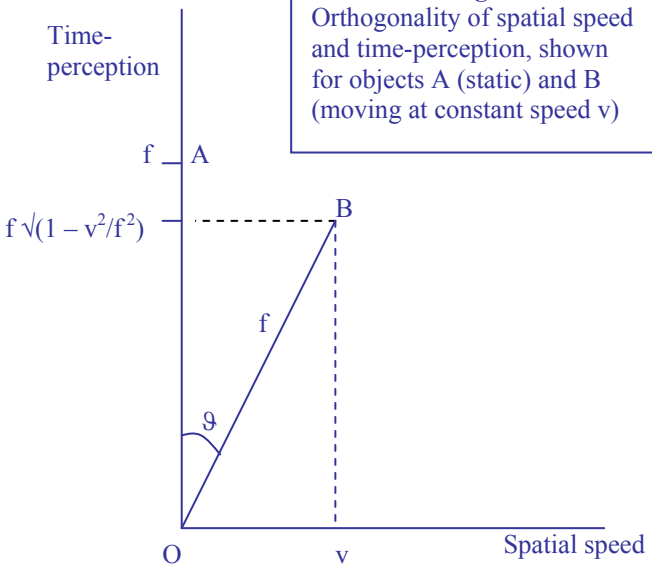

Fig. 1
Orthogonality of spatial speed and time-perception, shown for objects A (static) and B (moving at constant speed v)

The significance of figure 1 may be extended to encompass the state, as perceived by our object in motion, of other objects in other states of motion. If object B in figure 1 is in fact an observer (organic or manufactured) it will have no way of knowing that it is in motion. Considering itself at rest, it will evaluate all that it perceives on the basis that its hypothetical spiral is in fact a continuous circle, i.e. that line OB is the true vertical. Note that this is not

[3] If different flow speeds f1, f2, … were to apply in different elements of a static object then their intrinsic components f1', f2', … in that object in motion would bear a different mathematical relationship to each other than do f1:f2:… Such anomalous intrinsic flows would become increasingly out of step in time, leading to a breakdown in the structural stability of the object in motion. It is clear from daily experience that this is not the case.

[4] Equal scaling of axes gives slope of OB as effectively loop-perimeter/offset, rather than loop-diameter/offset.

just a matter of sensory perception, it is an intrinsic bias (literally) common to all material elements, whatever their nature, of the object or system moving with constant velocity v. Note also that at this point direction of travel becomes relevant; two observers travelling at the same speed in different directions will experience the same degree of time-dilation, but they will assuredly **not** perceive each other as at rest relative to themselves.

Continuation of this line of reasoning yields the result that **all** observers, static or in motion, will perceive the speed of another object identically if, and only if, that other object is travelling with speed f, the universal rate of structural flow (this result can be proved for all directions of motion relative to any observer's line of travel). Since such is known to be true of c, the speed of light (in a vacuum), this identifies f as that value – i.e. all matter is composed of cyclic energy-flows travelling at the speed of light. It also explains, in clear scientific terms, the reason for the invariance of the speed of light as observed from all inertial frames of reference.

Lorentz & the Special Theory of Relativity

Further application of these principles to a suitably-specified scenario provides a set of equations which define the transformation (of time, x, y and z values) from a static frame of reference to one that is in motion. These equations correspond identically to those of the Lorentz Transformation, used in Special Relativity to move between reference-frames.

If the static state is defined in terms of t, x, y & z and the motion state is defined in terms of t', x', y' & z', then this set of equations gives the well-known relationship:

$$(ct')^2 - (x'^2 + y'^2 + z'^2) = (ct)^2 - (x^2 + y^2 + z^2)$$

In SR this relationship states that the 4-dimensional spacetime vector between two events measures the same from any frame of reference. Interpreted in the light of the nature of reality as presented here, it can be shown to affirm the constancy of matter-energy interactions across all inertial reference frames – Einstein's Special Theory of Relativity.[5]

On each side of the above relationship the term in t^2 is of the opposite sign to those in x^2, y^2 and z^2. This reflects the fact that the SR 4-vector of spacetime has an imaginary time component which, squared, introduces a factor of -1. The imaginary nature of the time dimension in SR is undoubtedly due to the premise that material objects move through time – whereas in actuality time effectively flows through those objects.

[5] SR is inferred directly from the assumed equivalence of all inertial reference frames. Quantum Relativity as given here shows this consistency to be a consequence of the nature of matter.

Absolutely

SR regards the invariance of the speed of light as an inherent quality of light itself, rather than a feature of its interaction with matter. Similarly it sees time-experience as a fundamental quality of matter, rather than a consequence of some deeper process. These two views lead inevitably to the notion of a totally relative universe with no fixed frame of reference.

QR as presented here, on the other hand, gives a perspective on reality which leads to definition of an absolutely static reference frame from which the motion of all other frames may be deduced – the SR assumption of reciprocity is not supported here. This in turn rules out multiple truths as to ordering of cosmic events – there is one actual sequence of events and differing subjective perceptions of that sequence. Faster-than-light travel does **not** imply travel through time; questions over causality and nonlocality (for those who study such things) cease to be an issue in this respect. Those familiar with the Lorentz Transformation will see that, although still skew-symmetric in its usual form (v replaced by –v in the inverse transform), v should in fact be replaced by v', which is not equal to –v; the inverse transformation is then asymmetric to the original.

Inertia and Inert Mass

Since a moving object has some of its energy flow 'externalised' as the extrinsic component of motion, intrinsic flow rate is reduced. To compensate for this in maintaining structural integrity, flux density must be increased proportionately. This is inertia: motion is in fact a response to injection of additional energy, thereby maintaining the balance of structural flux interactions.

There is no reason why this should be by increase in flow speed, and various reasons why it should not. Most obviously, energy content of electromagnetic energy-flow as emitted from matter (e.g. as light) is proportional to frequency, speed is constant. Additional energy absorbed by matter as energy of motion, giving a proportionate increase in frequency of structural energy flows, would exactly balance the reduction in the intrinsic flow component.

Development of this view leads directly to the mass-energy relationship $E = mc^2$.

Subtle Matter

The view of reality presented above gives credence to the notion that our material reality may actually be a vibrational pattern imposed on some meta-matter substrate, like ripples on a lake. This substrate could correspond to that which is referred to in esoteric literature as 'subtle matter'. Detection of this substrate with instruments composed of normal matter would of course have to be by indirect means.